

GRC Ground Support Facilities

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Abstract:

The ISS Program is conducting an 'ISS Research Academy' at JSC the first week of August 2010. This Academy will be a tutorial for new Users of the International Space Station, focused primarily on the new ISS National Laboratory and its members including Non-Profit Organizations, other government agencies and commercial users. Presentations on the on-orbit research facilities accommodations and capabilities will be made, as well as ground based hardware development, integration and test facilities and capabilities. This presentation describes the GRC Hardware development, test and laboratory facilities.



John H. Glenn Research Center at Lewis Field

GRC Ground Support Facilities

A Presentation to the ISS Research Academy

August 3-5, 2010



Zero Gravity Research Facility – Bldg 110

John H. Glenn Research Center at Lewis Field



*Zero Gravity
Research Facility,
Building 110*



- The Zero G Facility provides a reduced gravity test capability unique in NASA and the Nation.
- Provides the highest quality reduced gravity level of any ground based facility, with acceleration levels on the order of 10^{-5} g.
- Largest microgravity drop tower in the world both in terms of available payload and microgravity test duration, providing 5.2 seconds for payloads weighing up to 1000 lbs.
- Currently supports ISS Research investigations in combustion science and the Exploration Technology Development and Demonstration Program (ETDD) in microgravity materials flammability and fire suppression.
- Facility is listed as a Historic Landmark on the National Historic Register and is managed by the Facilities and Test Directorate.



2.2 Second Drop Tower – Bldg 45

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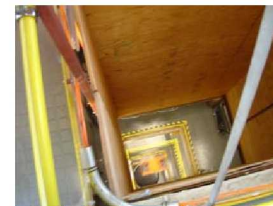


2.2 s Drop Tower, Building 45

Lifting rig to top of tower



Drop!



- The 2.2 s Drop Tower provides the capability to test experiment hardware, concepts, and systems in a high quality reduced gravity environment for a duration 2.2 seconds.
- Typically used as a stepping stone to the Zero G Facility or reduced gravity aircraft due to its low operating costs and high throughput.
- Facility can support up to 12 tests per day and provides acceleration levels on the order of 10^{-4} g.
- Currently supports fundamental and applied research investigations slated for ISS including work in microgravity materials flammability and fire suppression.
- Facility is managed by the Facilities and Test Directorate



Low Gravity Aircraft

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GRC research on board aircraft.

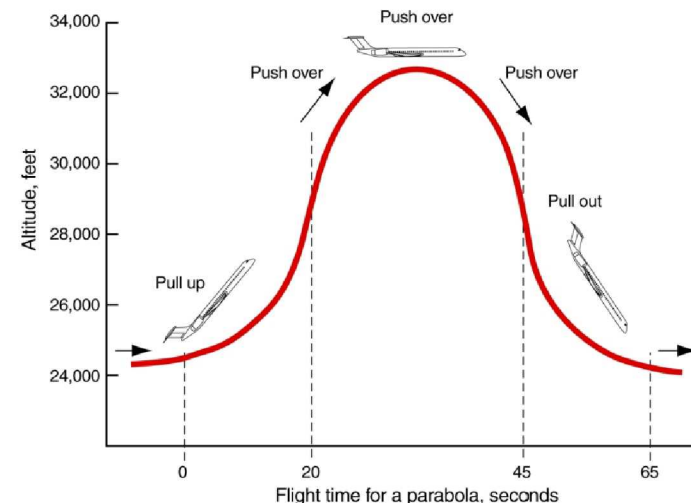


JSC C-9B aircraft



Zero-G Corp 727 aircraft

- NASA C-9B aircraft provides about 20 seconds of microgravity by flying in a parabolic trajectory.
- Zero-G Corp was contracted to provide additional reduced gravity flights.
- Experiment packages are attached to the aircraft cabin floor to experience near-zero gravity levels.
- For smaller experiments, they can be ‘free floated’ in the aircraft which reduces the overall gravity (g) effects.
- The aircraft is capable of providing “partial gravity” environments, including Lunar (0.17g) and Martian (0.38g) levels.

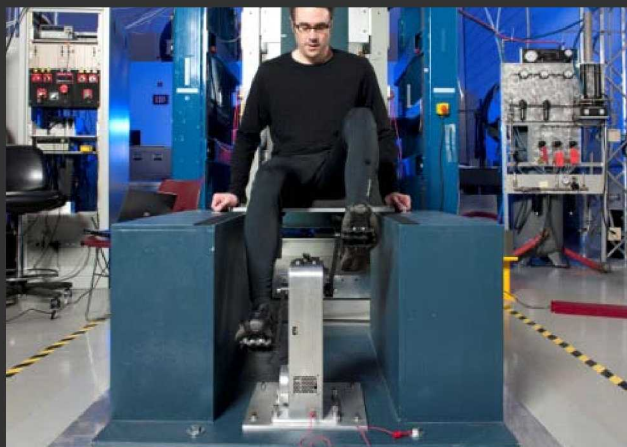




Exercise Countermeasures Laboratory (ECL)



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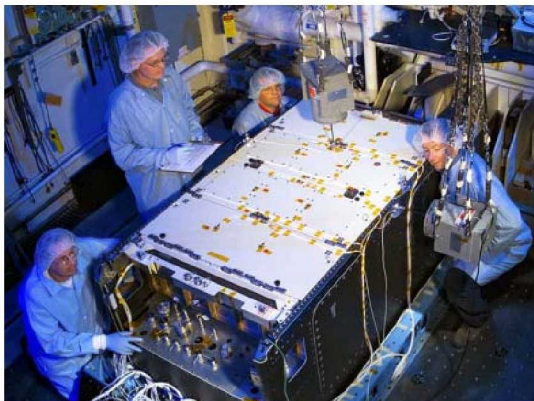
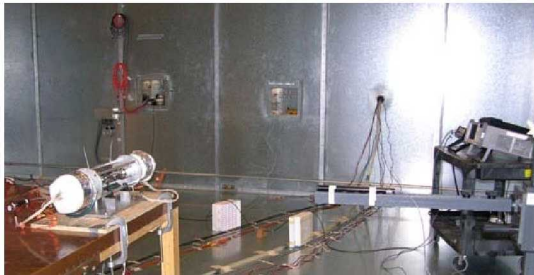


- The Exercise Countermeasures Laboratory (ECL) is a GRC test facility serving the NASA Human Research Program intramural and extramural investigators
- Provides a ground-based simulation of in-flight (0-g) and surface (fractional-g) exercise
- Floating treadmill and high-fidelity vibration isolation simulation
- Supports development and validation of advanced exercise countermeasure devices, requirements, and exercise prescriptions for Space Exploration
- Continually advancing methods to simulate exercise during space flight, helping researchers understand how to better combat spaceflight de-conditioning including bone loss and muscle atrophy



Environmental Test Labs

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- The **Acoustics Test Lab (ATL)** consists of a fully vibration-isolated anechoic/hemi-anechoic test chamber providing 99% normal incidence sound absorption at frequencies at and above 100 Hz and measurements as low as 50 Hz with engineering grade precision.
- The **Electromagnetic Interference Lab (EMI)** is fully equipped to verify emissions and susceptibility requirements in either reverberant or anechoic environments per MIL-STD-461 specifications.
- The **Structural Statics Lab (SSL)** performs testing to verify the structural integrity of space flight and ground test hardware and verifies modes of failure when the design is subjected to simulated service loads.
- The **Structural Dynamics Lab (SDL)** offers a wide range of vibration qualification test capabilities including: random sine, short transients, modal, fatigue, hi-temp testing, and structural loads testing.

Photos: Acoustics Test Lab (top), Electromagnetic Interference Lab (middle), Structural Dynamics Lab (bottom)



ISS Fluids and Combustion Facility (FCF) Ground Integration Units (GIUs)

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*ISS FCF GIUs,
Building 333*

- Building 333 at GRC is the primary integration and operations facility for the ISS FCF and for FCF payload ground processing, integration and final verification testing.
- The FCF GIUs are flight-equivalent FCF racks that are located at GRC in the Building 333 High Bay and provides the capability to simulate and trouble shoot on-orbit operations.
- The GIUs are also used for final, pre-flight integration and verification testing of payload equipment and/or facility upgrades.
- Testing in the GIU includes high-fidelity interface verification (with interface to the ISS Payload Rack Checkout Unit (PRCU) resource simulator) and an opportunity to provide mission simulation to fully exercise the hardware and software interfaces.
- The configuration of the GIU is carefully controlled to use it for both simulating on-orbit operations and verification testing of new payload hardware and facility upgrades prior to their launch to ISS.



*Combustion
Integrated Rack*



*Fluids
Integrated Rack*



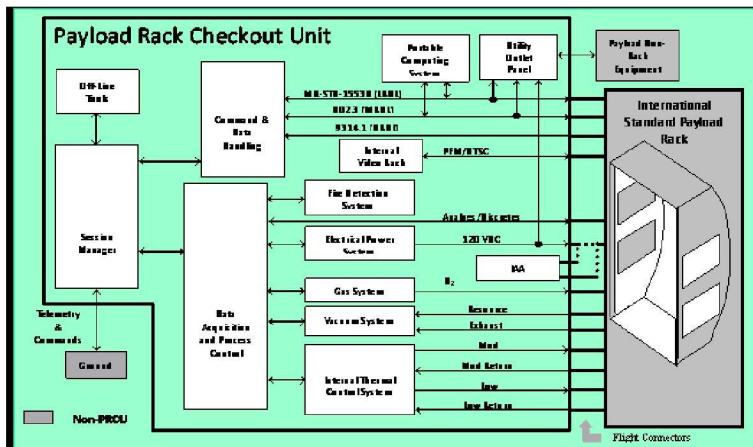
Payload Rack Checkout Unit (PRCU) Facility

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*PRCU,
Building 333*

- The PRCU is an integration and test environment that provides high fidelity emulation of the data and resource interfaces between the International Standard Payload Rack (ISPR) and the International Space Station (ISS).
- The PRCU supports test and verification of a payloads' interface to the Command & Data Handling (C&DH) system, electrical and optical internal video system, Electrical Power System (EPS), Fire Detection System (FDS), Impedance Analysis Assembly (IAA), Nitrogen Gas System, Portable Computing System, Internal Thermal Control System (ITCS), and Vacuum System.
- The PRCU allows the payload developer to complete development and verification prior to payload shipment to KSC
- The PRCU interface is functional for the flight rack, the GIUs, and the EDU.





NASA Glenn Research Center's Telescience Support Center (TSC)

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*Fluids & Combustion Facility
Mission Operations at TSC,
Building 333*

- The GRC TSC is NASA's vision to provide local access to world class science hardware in space. This limited access facility can accommodate up to 22 different payloads and has room for over 40 cadre positions. The center has been in continuous operation for over 10 years, providing support for payloads on both Shuttle and the ISS. A robust complement of services are available to support payload mission operations.
- The quality of scientific and engineering data is enhanced while the long-term operational costs of experiments are reduced because principal investigators and engineering teams can operate their payloads from their home institutions. Using TSC-provided workstations, cadre members receive a command and control capability as well as the ability to view their real time telemetry.
- Secure, dedicated audio, video, and data interfaces are provided to payload teams, including a digital stream of two channels of video from the ISS and the ability to communicate directly with the ISS crew. Hardware and software provide the ability to send commands to payload hardware and to receive feedback via telemetry data and video links.



Hardware Assembly Facility – ZIN Technologies

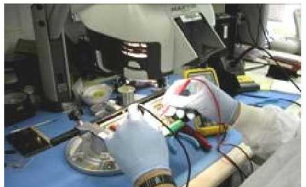
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Laboratories



Manufacturing



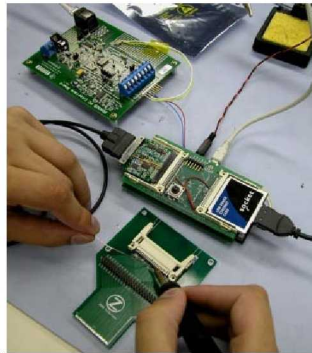
Assembly



Integration & Test



ZIN Facilities Have Produced
133 Flight Payloads



ZIN Technician Completes an
Electronics Circuit Board



ZIN Machine Shop

- ZIN Technologies occupies 50,000 square feet in its AS9100 certified corporate headquarters adjacent to GRC.
- Our facility includes a separate 20,000 square feet space/aerospace flight hardware assembly area with an electronic buildup capability.
- Hardware Assembly Area - Clean room & laminar flow workspace are available for contamination-sensitive components. Our laboratories can be operated as a class 100,000 visibly clean room with a humidity control system for ESD prevention. Laser-safe work areas and a thermal test chamber are available.
- Electrical Component Assembly- The assembly area is equipped with a circuit board fabrication laboratory where circuit boards can be processed, cleaned and conformal-coated.
- Machine Shop - ZIN has an in-house capability and 5000 sq ft work area for fabrication of prototype hardware and limited quantities of deliverable hardware.
- Property Management - ZIN has an approved procurement department, Government Property Control System certified by the Defense Contract Management Agency, shipping and receiving area, and a climate controlled bonded storage area.